Open Architecture Overview

National Defense Industrial Association Systems Engineering Conference

CAPT Tom Strei

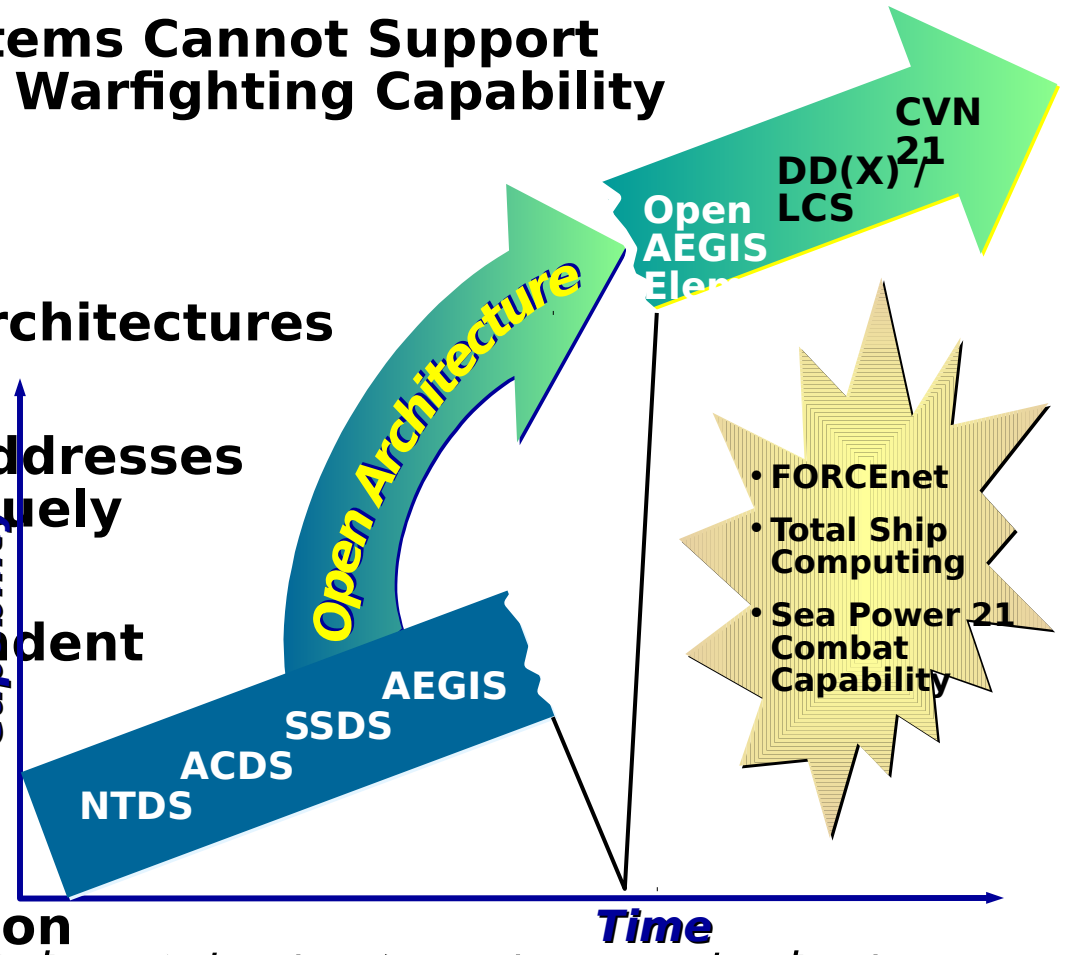
PEO IWS Open Architecture

Purpose of Brief

- **Explain Why New Approaches to Implementation of Warfighting Capabilities are Necessary**
- **Define OA Concepts as Applicable to Integrated Warfighting Systems**
- **Describe the Approach Being Used to Create and Deploy OA Systems**

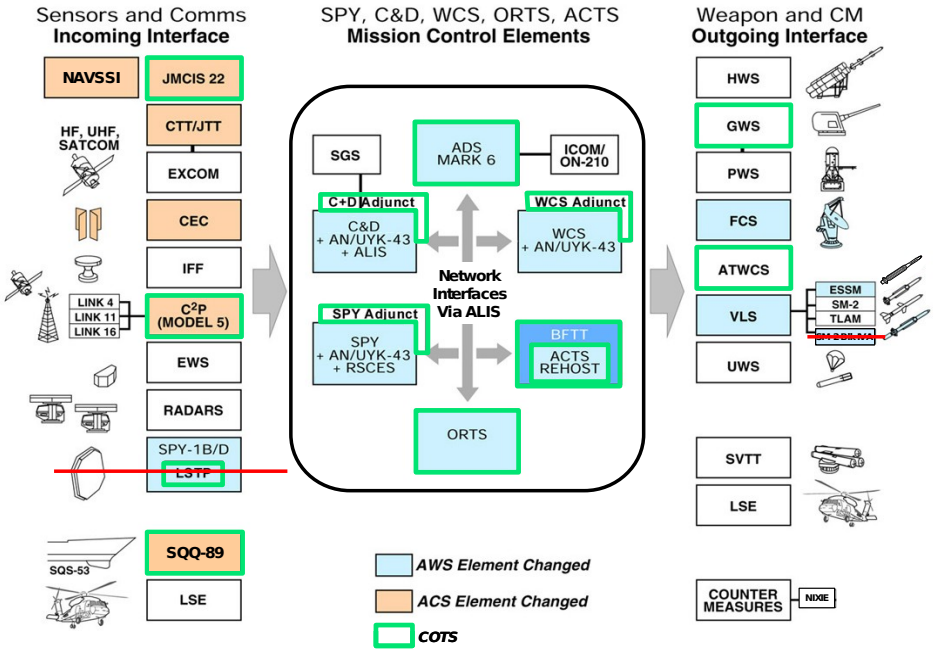
Why OA?

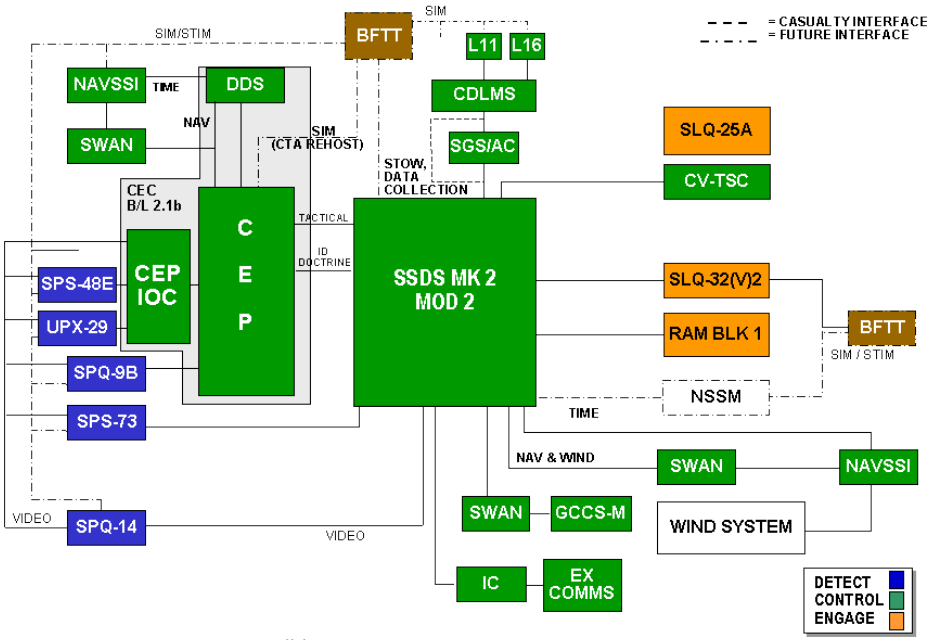
- **Enables Required Combat Capability**
  - Current Computing Systems Cannot Support Emerging Sea Power 21 Warfighting Capability Requirements
- **Affordability**
  - In-service Computing Architectures are Unaffordable
  - Each Warfare System Addresses Common Problems Uniquely
  - Software and Hardware Changes Are Interdependent
- **Joint Interoperability**
  - In-service Architectures can not Support FORCEnet Implementation



Key to Affordable 21st Century Joint Combat Capability

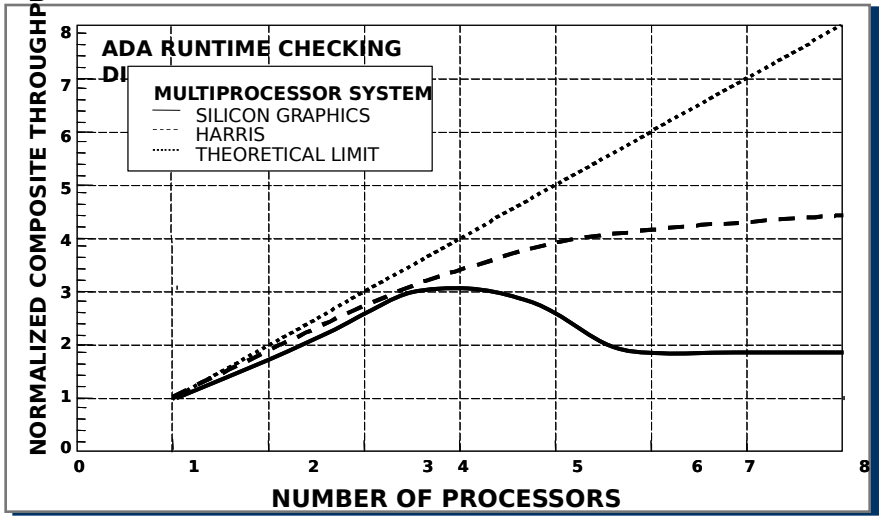
Computing Environment of Today's Ships

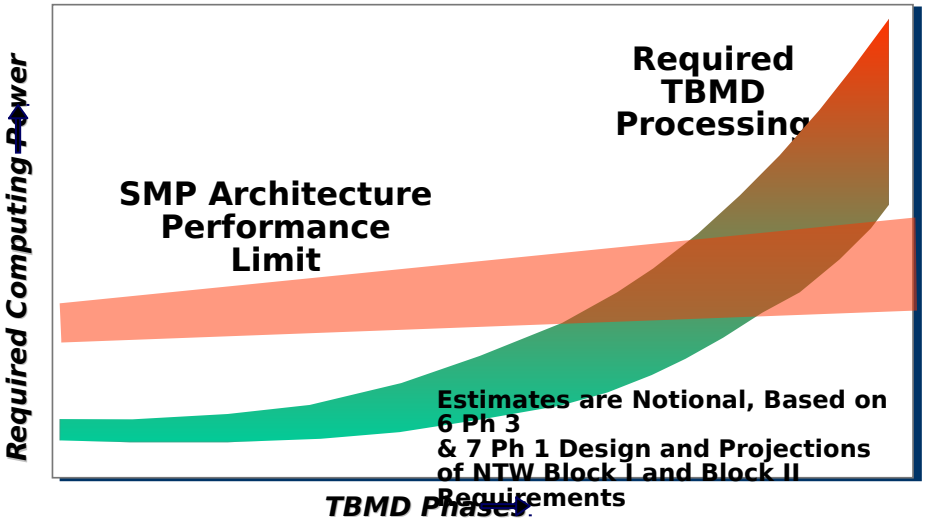




Increased Warfighting Capability

- **Current Aegis Architecture Cannot Meet Processing Needed to Support TBMD Engagement**
- **OA Computing Plant Scaleable to Meet Increased Processing Demand**




Required Computing Power
Required TBMD Processing
SMP Architecture Performance Limit
Estimates are Notional, Based on 6 Ph 3 & 7 Ph 1 Design and Projections of NTW Block I and Block II Requirements
TBMD Phases

OA Enables "and Ship" Capability

Open Computing System Definition

Open Computing System: ***A System That Implements Sufficient Open Specifications for Interfaces, Services, and Supporting Formats to Enable Properly Engineered Components to be Utilized Across a Wide Range of Systems With Minimal Changes, to Interoperate With Other Components on Local and Remote Systems, and to Interact With Users in a Style That Facilitates Portability***

Key Open Computing System Characteristics:

- **Based on Open, Publicly Available Specifications — Preferably Maintained as Standards by a Consensus Process, E.G., By an Internationally Recognized Governing Group**
- **Well-defined, Widely Used Non-Proprietary (Standard) Interfaces, Services and Formats**
- **Durable (Stable or Slowly Evolving) Component Interfaces That Facilitate Component Replacement and Addition of New Capabilities**
- **Upgradeable Through Incorporation of Additional or More Capable Components With Minimal Impact on the System**

— Open Systems Joint Task Force

What is OA?

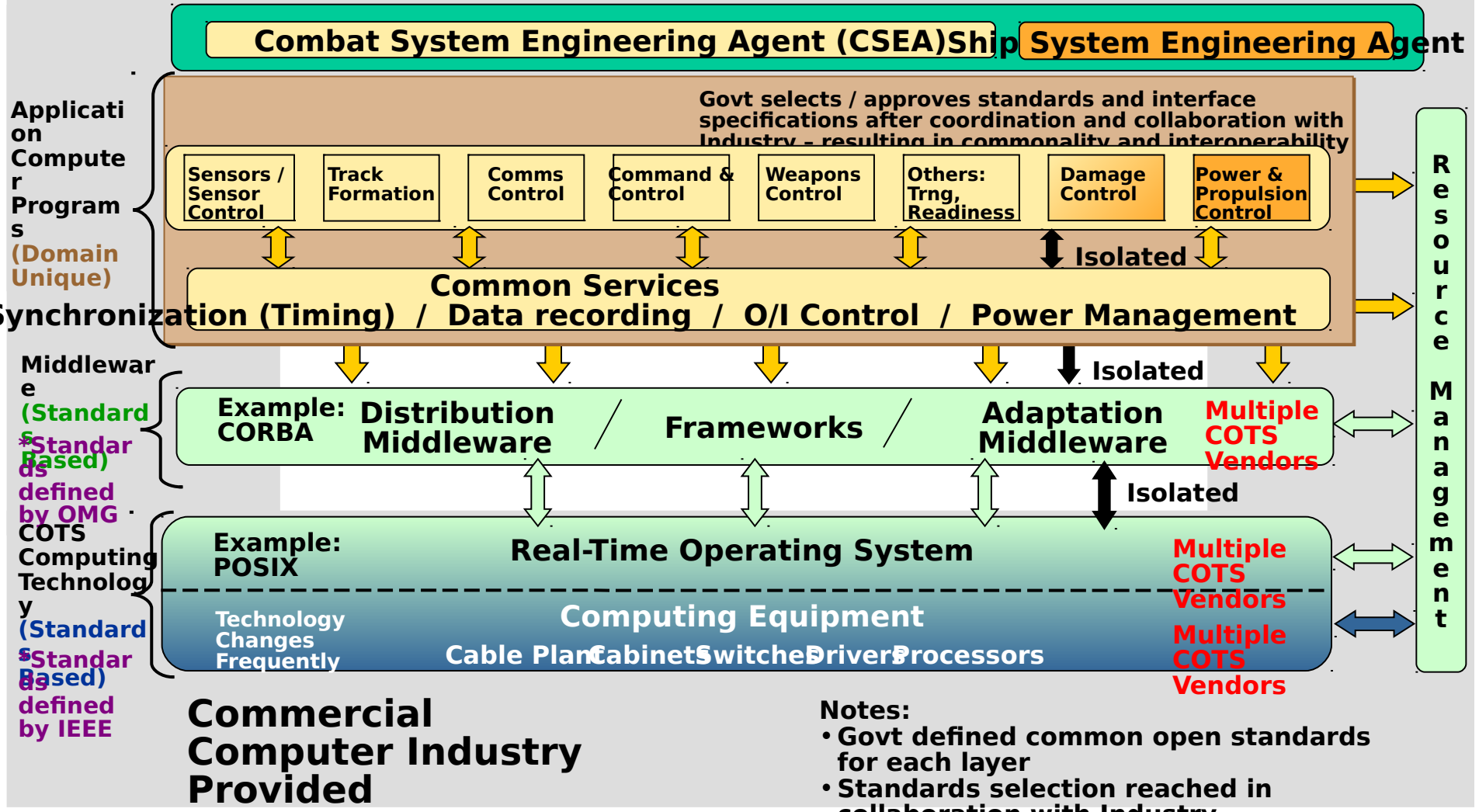
- A Technical Architecture… Mainstream Standards Based OA Computing Environmen
  - Middleware
  - Operating Systems
  - Mainstream COTS Computing Techn
- A Functional Architecture…Techni Reference Model That Identifies S Domains and Interface Relationsh
  - Warfighting Applications
  - Common Service Applications
- Specifications, Standards & Design Guidance
- An OA Approach is an Integrated Tec and Business Strategy Focused on Increasing the Effectiveness of a Capability, While Decreasing Cost, Increasing Operational Life and Providing Improvements Through Planned Upgrades

Key Open Computing System Characteristics

- Based on Open, Publicly Available Specifications
- Well-Defined, Widely Used Non-Proprietary (Standard) Interfaces
- Durable Component Interfaces
- Decoupled Hardware and Software Upgrades

Foundation for 21st Century Combat System Designs

OA Technical Architecture



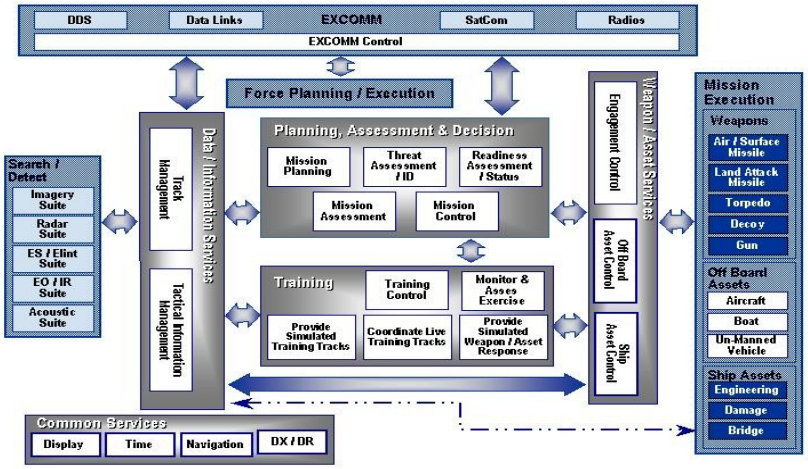
Notes:

- Govt defined common open standards for each layer
- Standards selection reached in collaboration with Industry

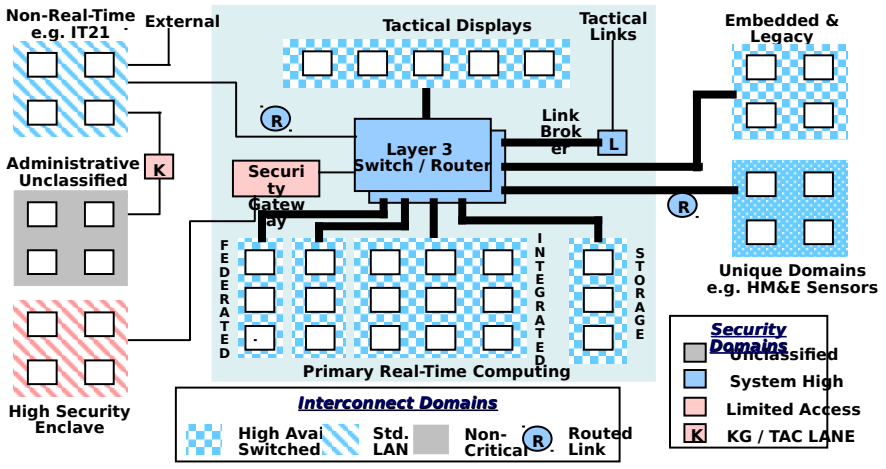
STANDARDS and MIDDLEWARE Isolate Applications From Technology Change

OA System Architecture Views

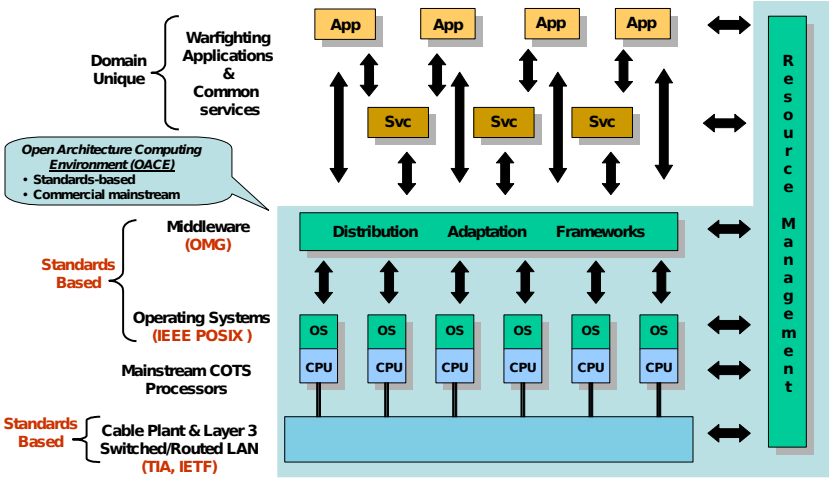
Functional View



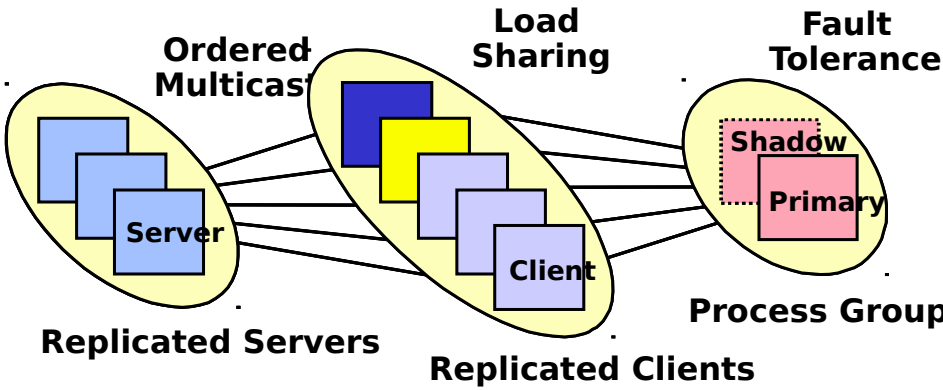
Network & Computer View



Operating System & Middleware View

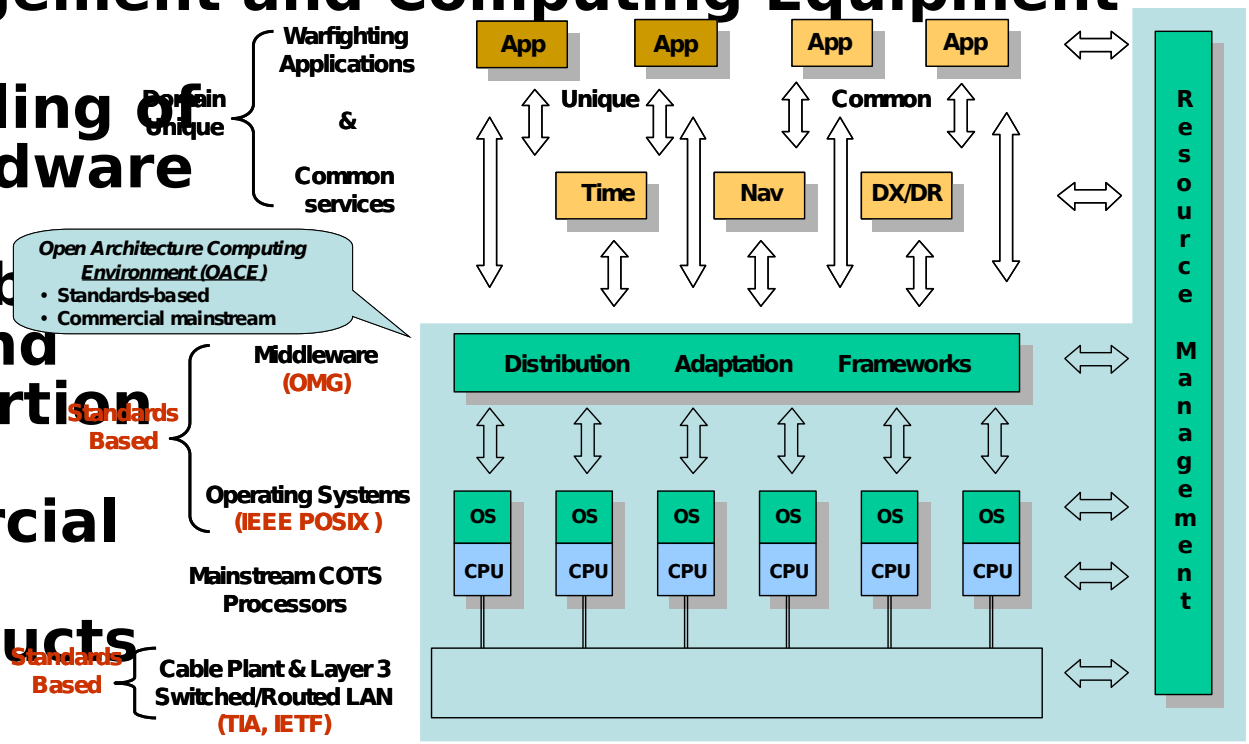


Computer Program View



OA Technical Architecture

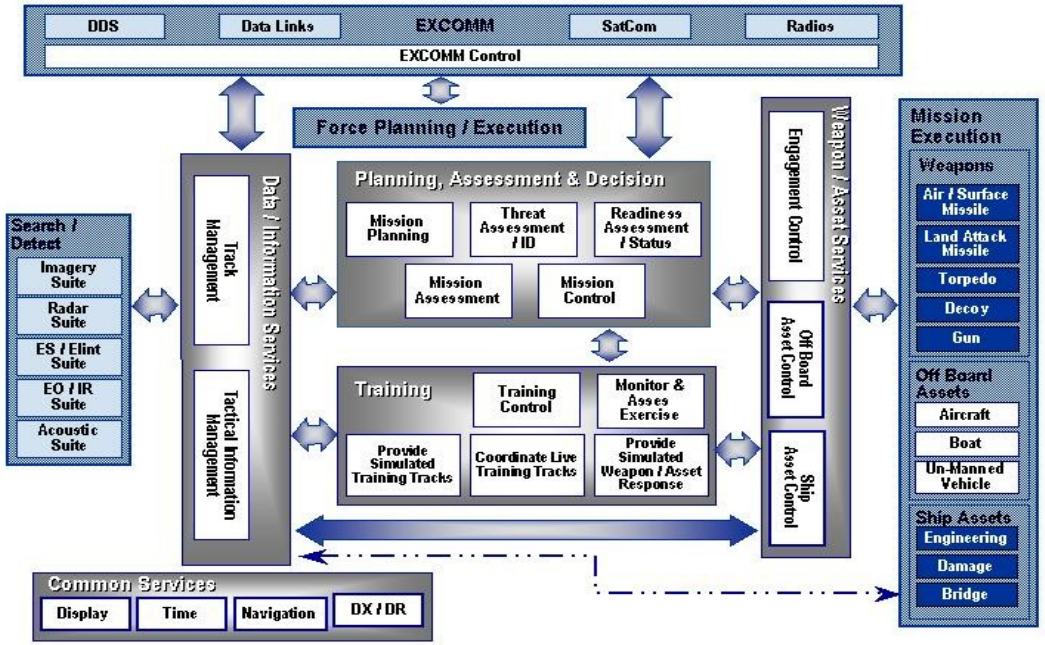
- Standards Based Computing Environment
- Includes Middleware, Operating System, Resource Management and Computing Equipment
- Enables Decoupling of Software to Hardware
- Enables Affordab COTS Refresh and Technology Insertion
- Utilizes Commercial Mainstream Computing Products



STANDARDS and MIDDLEWARE Isolate Applications From Technology Change

OA Functional Architecture

- **Translates System Requirements to Functional Requirements and Allocates Functions to Logical Groupings**
- **Provides Basis for Identifying Common Service Applications and Co**
- **Provides Standardiz Common Componen (e.g. C2, ID, etc) an Interfaces Across Sy**
- **Provides Standardiz of Design Patterns a Data Models**



Data Model Enabler For Application Re-Use Across Platforms

OA Platform and Process Concepts

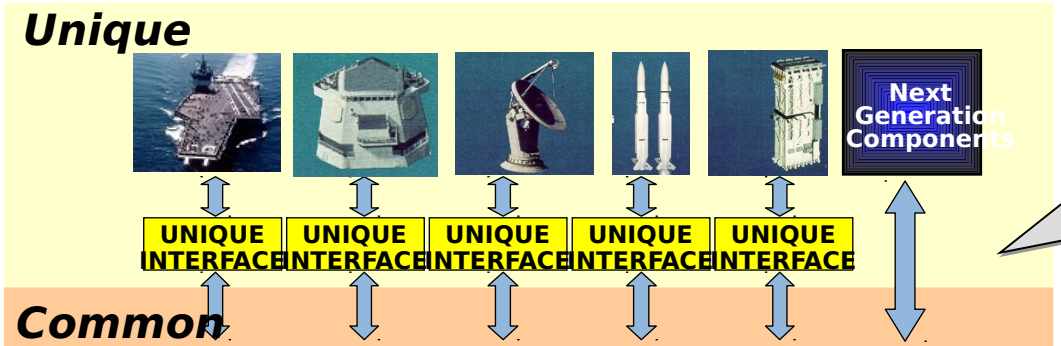
Validation

OATF is . . .

- Gov't Controlled Risk Reduction
- Industry Devel. & Participation
- Common Functions & Services
- OA Computing Environment
- Stimulation of Unique Interfaces

OATF validates . . .

- OA Computing Environment
- Common Functions & Applications
- Total Ownership Cost
- New Technology Insertion (RTIP)



Industry Builds Systems
- NAVY Control Interfaces

Collaborate with Defense Industry:
- Common Component Specifications for Industry to Build
- Interface Specifications

Collaborate with Computing Industry
- Computing Standards
- Technology Base

***Standards and Guidance*: Architecture, Technologies, Products, Design Methods**

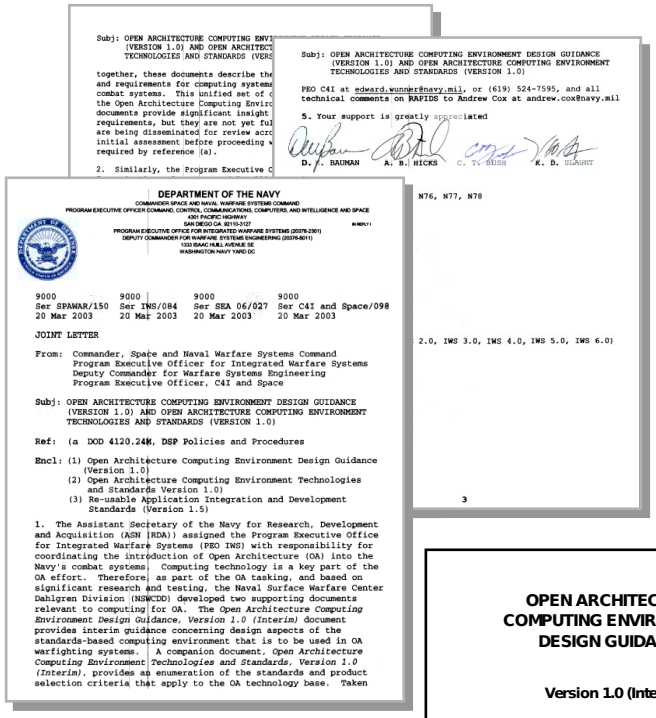
S&T investigations

Info Transfer | Middleware
Oper. Systems | Resource Mgt.

Navy Controls
- Standards
- Specifications
- Interfaces

OA Standards, Guidance and Definition Document

Technical Architecture



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WASHINGTON NAVY YARD DC

9000 Ser SPAWAR/150 20 Mar 2003 | 9000 Ser IWS/084 20 Mar 2003 | 9000 Ser SEA 06/027 20 Mar 2003 | 9000 Ser C4I and Space/098 20 Mar 2003

JOINT LETTER

From: Commander, Space and Naval Warfare Systems Command
Program Executive Officer for Integrated Warfare Systems
Deputy Commander for Warfare Systems Engineering
Program Executive Officer, C4I and Space

Subj: OPEN ARCHITECTURE COMPUTING ENVIRONMENT DESIGN GUIDANCE (VERSION 1.0) AND OPEN ARCHITECTURE COMPUTING ENVIRONMENT TECHNOLOGIES AND STANDARDS (VERSION 1.0)

Ref: (a DOD 4120.24M, DSP Policies and Procedures

Encl: (1) Open Architecture Computing Environment Design Guidance (Version 1.0)
(2) Open Architecture Computing Environment Technologies and Standards Version 1.0)
(3) Re-usable Application Integration and Development Standards (Version 1.5)

1. The Assistant Secretary of the Navy for Research, Development and Acquisition (ASN [RDA]) assigned the Program Executive Office for Integrated Warfare Systems (PEO IWS) with responsibility for coordinating the introduction of Open Architecture (OA) into the Navy's combat systems. Computing technology is a key part of the OA effort. Therefore, as part of the OA tasking, and based on significant research and testing, the Naval Surface Warfare Center Dahlgren Division (NSWCDD) developed two supporting documents relevant to computing for OA. The *Open Architecture Computing Environment Design Guidance, Version 1.0 (Interim)* document provides interim guidance concerning design aspects of the standards-based computing environment that is to be used in OA warfighting systems. A companion document, *Open Architecture Computing Environment Technologies and Standards, Version 1.0 (Interim)*, provides an enumeration of the standards and product selection criteria that apply to the OA technology base. Taken

Subj: OPEN ARCHITECTURE COMPUTING ENVIRONMENT DESIGN GUIDANCE (VERSION 1.0) AND OPEN ARCHITECTURE COMPUTING ENVIRONMENT TECHNOLOGIES AND STANDARDS (VERSION 1.0)

PEO C4I at edward.wunner@navy.mil, or (619) 524-7595, and all technical comments on RAPIDS to Andrew Cox at andrew.cox@navy.mil

5. Your support is greatly appreciated

D. J. BAUMAN A. B. HICKS C. T. BUSH K. D. SLAGHT

N76, N77, N78

2.0, IWS 3.0, IWS 4.0, IWS 5.0, IWS 6.0)

3

OPEN ARCHITECTURE COMPUTING ENVIRONMENT TECHNOLOGIES AND STANDARDS

Version 1.0 (Interim)

10 March 2003

OPEN ARCHITECTURE COMPUTING ENVIRONMENT DESIGN GUIDANCE

Version 1.0 (Interim)

10 March 2003

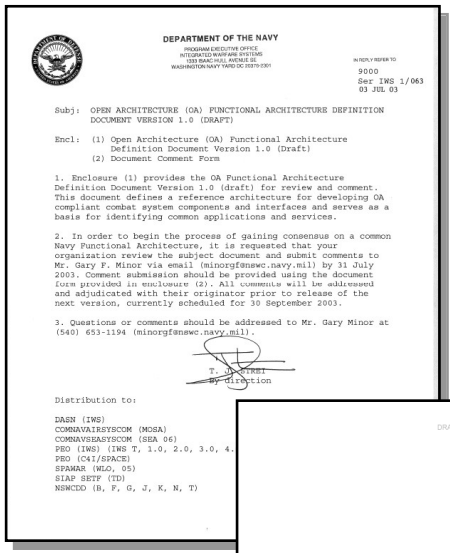
DRAFT

RAPIDS
RAPID APPLICATION INTEGRATION AND DEVELOPMENT STANDARDS

PEO C4I and Space
24 Feb 2002

DRAFT
V1.5

Functional Architecture



DEPARTMENT OF THE NAVY
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IN REPLY REFER TO
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Subj: OPEN ARCHITECTURE (OA) FUNCTIONAL ARCHITECTURE DEFINITION DOCUMENT VERSION 1.0 (DRAFT)

Encl: (1) Open Architecture (OA) Functional Architecture Definition Document Version 1.0 (Draft)
(2) Document Comment Form

1. Enclosure (1) provides the OA Functional Architecture Definition Document Version 1.0 (draft) for review and comment. This document defines a reference architecture for developing OA compliant combat system components and interfaces and serves as a basis for identifying common applications and services.

2. In order to begin the process of gaining consensus on a common Navy Functional Architecture, it is requested that your organization review the subject document and submit comments to Mr. Gary F. Minor via email (minorgf@nswc.navy.mil) by 31 July 2003. Comment submission should be provided using the document form provided in enclosure (2). All comments will be addressed and adjudicated with their originator prior to release of the next version, currently scheduled for 30 September 2003.

3. Questions or comments should be addressed to Mr. Gary Minor at (540) 653-1194 (minorgf@nswc.navy.mil).

T. J. [illegible]
By direction

Distribution to:

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SPAWAR (WLO, 05)
SIAP SETF (TD)
NSWCDD (B, F, G, J, K, N, T)

DRAFT

OPEN ARCHITECTURE (OA) FUNCTIONAL ARCHITECTURE (FA) DEFINITION DOCUMENT VERSION 1.0

DRAFT

JUNE 2003

Prepared for:

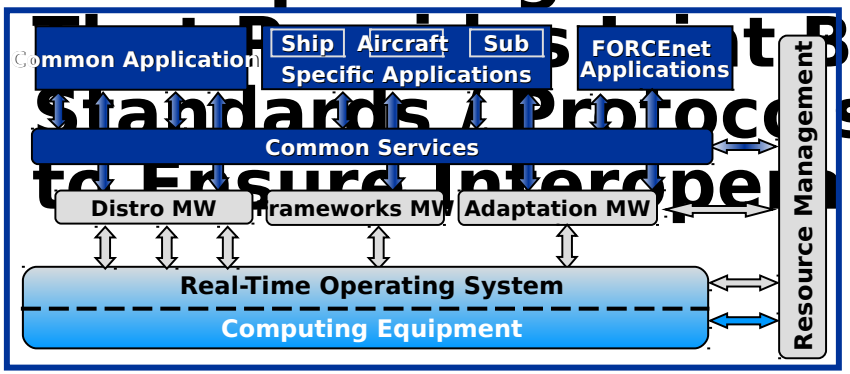
Program Executive Office, Integrated Warfare Systems
Program Manager, Open Architecture (OA)
1333 Isaac Hull Avenue SE
Washington Navy Yard, DC 20376-2301

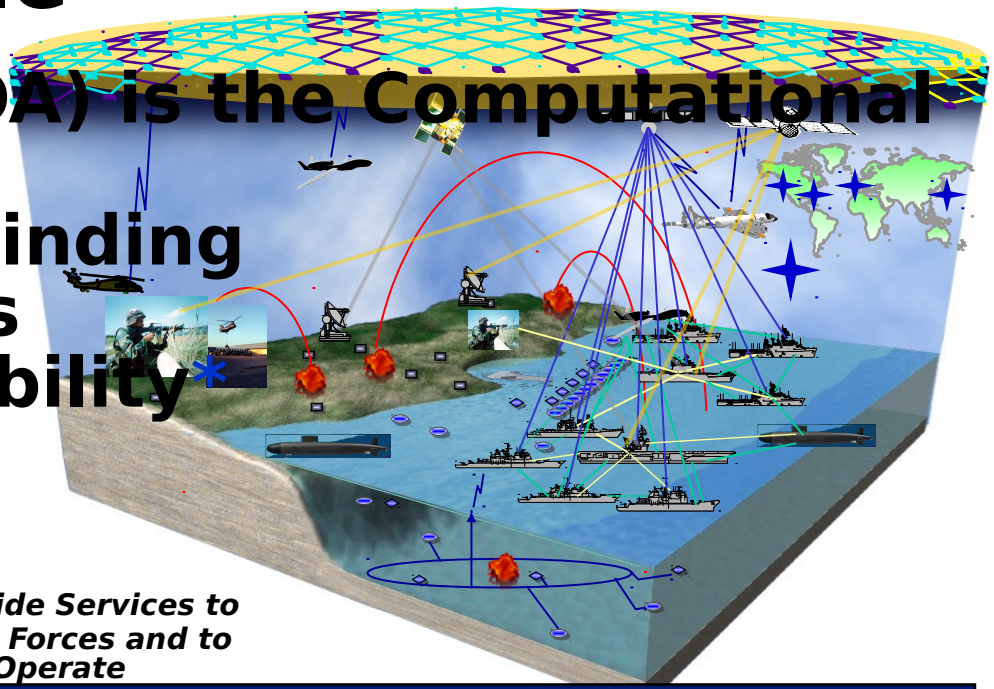
Prepared by:

Naval Surface Warfare Center
Dahlgren Division
17430 Dahlgren Road
Dahlgren, VA 22448-5100

Interoperability With a Netted Maritime

- **Network Centric Warfare is Essential to Joint / Coalition Force Warfighting**
- **FORCEnet Leads the Maritime Architectural Framework for the GIG**
- **Open Architecture (OA) is the Computational Underpinning That Provides Joint Binding Standards / Protocols to Ensure Interoperability***





* *"The Ability of Systems, Units, or Forces to Provide Services to and Accept Services From Other Systems, Units, or Forces and to Use the Services so Exchanged to Enable Them to Operate Effectively Together." (JCS Pub 1)*

Required to Realize FORCEnet Cost and Performance

The Underlying Concept of OA

Surface Combatant Ship System

Common Computing Environment | Common Functions | Surface Combatant Ship Unique Functions | SCS System Unique & Common Applications & Interfaces

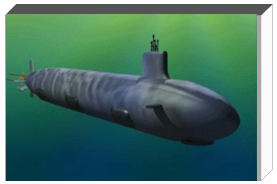
Aircraft System

Common Computing Environment | Common Functions | Aircraft Unique Functions | ACFT System Unique & Common Applications & Interfaces

CVN Ship System

Common Computing Environment | Common Functions | CVN Unique Functions | CV System Unique & Common Applications & Interfaces

Submarine System



Common Computing Environment | Common Functions | Submarine Unique Functions | Submarine System Unique & Common Applications & Interfaces

= Common Computing Environment + Common Platform Functions + Platform Unique Functions = **Interoperable System of Systems**

Common Architecture

OA Strategy

Current Ships (Back Fit)

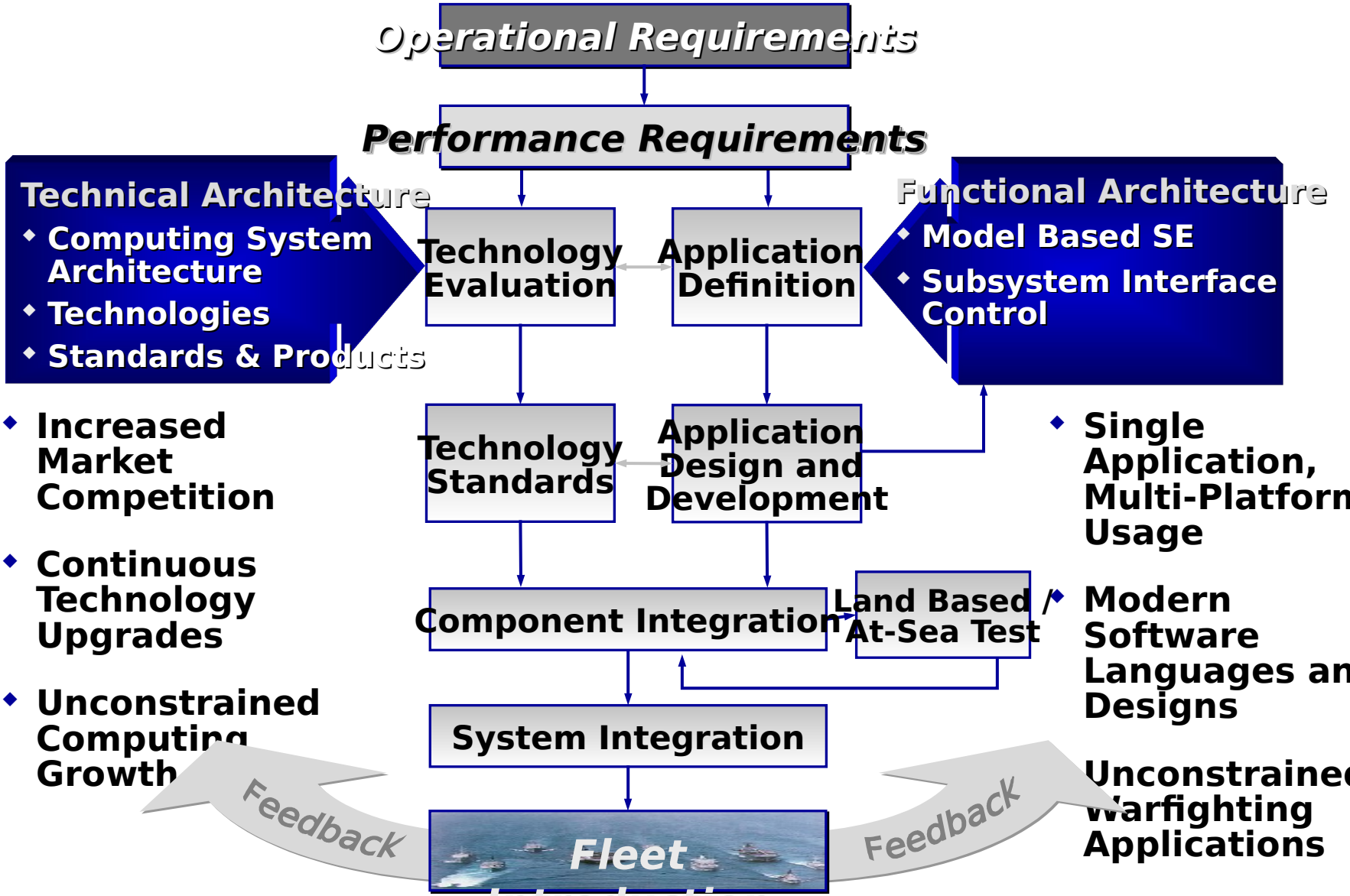
Future Ships

(e.g. DD(X), LCS, CVN 21, LHA(R) etc.)

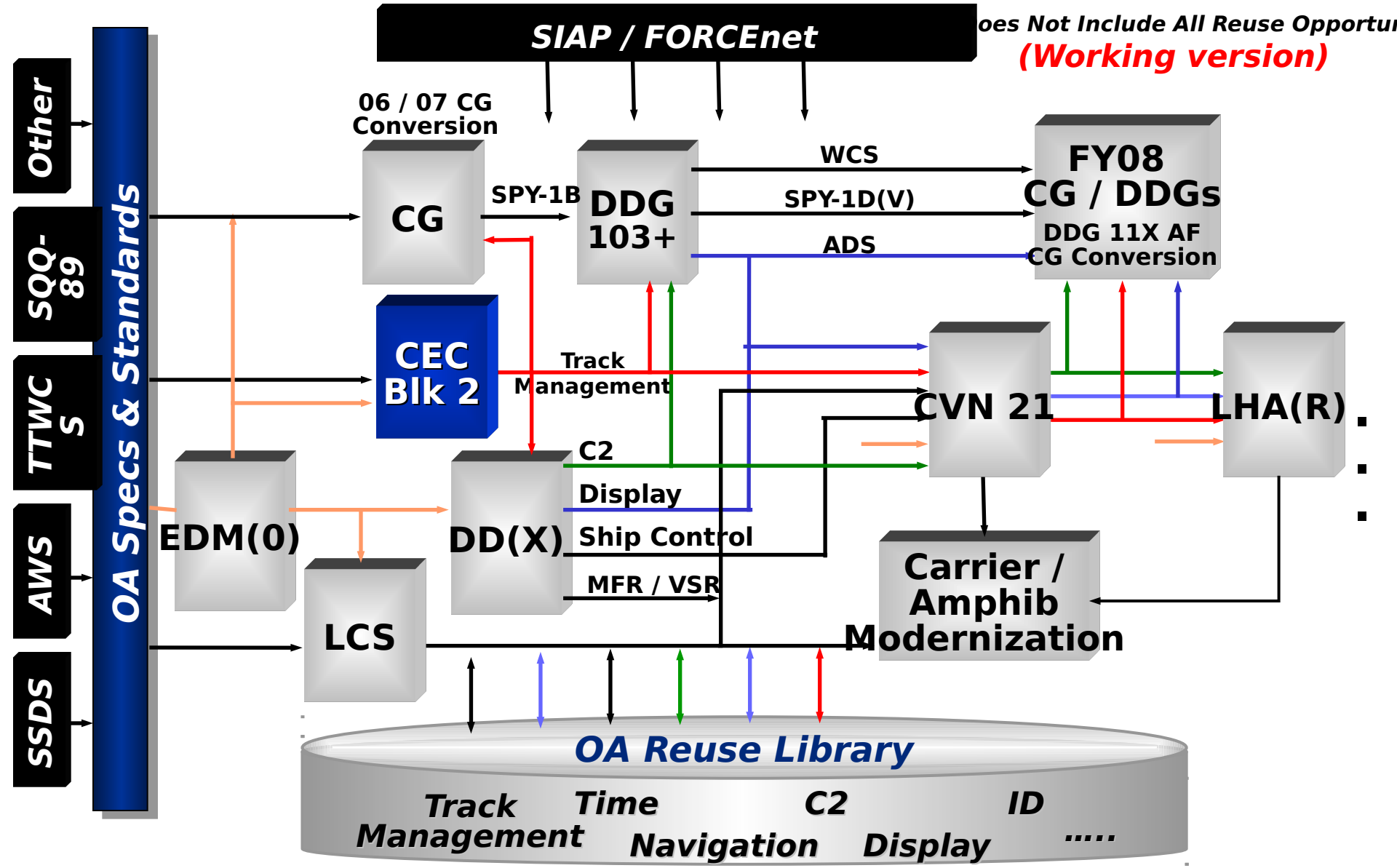
Net-Centric Concepts

(e.g. FORCEnet, SIAP

OA RTIP Process



Reuse Approach



Steps Already Taken

Policy

- ✓ Froze AEGIS and SSDS Future Upgrades to Sponsor Approved Requirements Only
- ✓ Rewrote CEC Blk II RFP to Include Requirement for an OA-Based Solution
- ✓ Released Interim Documents That Provide OA Specifications, Standards and Design Guidance
- ✓ Signed Cooperative MOAs With SPAWAR, SIAP and Ships
- ✓ Promulgated OA Contract Policy for All New Acquisition

Programmatic

- ✓ Stopped AEGIS B/L7p2 – AEGIS OA – Solution Too Narrowly Focused
- ✓ Redirected DD(X) From Vendor-WCK TSCE Solution
- ✓ Established OA Rapid Technology Insertion Program (“ARCI-like”)
- ✓ Realigning Budgets to Support OA in PR05 and POM 06

Organizational Alignment

- ✓ Established PEO IWS OA Directorate
- ✓ Established OA Organization With Big Navy Involvement (ASN RD&A), OPNAV, SEA 06, Other PEOs, Field Activities)
- ✓ Significant Interaction With Fleet, Type Commanders, Systems Commands, Industry and Field Activities

Technical Alignment

- ✓ Discussions With OPNAV N61 Regarding Alignment of OA With FORCEnet
- ✓ NAVSEA 06 Assigned OA Technical Authority
- ✓ NSWCDD Designated OA Technical Team Leader
- ✓ Government / Industry Technical IPTs

Summary

- **Today's Fleet Computing Architectures are Performance Limited and Expensive to Upgrade**
- **Implementation of Warfighting Functions Using Standard Based Solutions Will Enable Common, Interoperable Capabilities to be Fielded Faster at Reduced Cost**
- **Rapid Technology Insertion Program (RTIP) Will Provide Structural Approach for Introduction of OA Components into the Fleet**